

NON-PUBLIC?: N
ACCESSION #: 9106050263
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Calvert Cliffs, Unit 2 PAGE: 1 OF 06

DOCKET NUMBER: 05000318

TITLE: Reactor Protective System Actuation and Plant Trip Due to a Loss
of Feed Caused by Component Failure
EVENT DATE: 05/02/91 LER #: 91-005-00 REPORT DATE: 05/31/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 008

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: R. E. Franke, Engineer TELEPHONE: (301) 260-2060

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: SJ COMPONENT: CON MANUFACTURER: X999
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 1050 on May 2, 1991, a Low Steam Generator (SG) Level Reactor Protective System Trip occurred at Calvert Cliffs Unit 2 while attempting to control SG level oscillations at low power level. At the time of the trip, Unit 2 was operating in MODE 1 (Power Operation) at 8 percent power. The low SG level was caused by a loss of feedwater event when the operating SG Feed Pump (SGFP) was lost due to a speed controller failure.

The initiating loss of feed event was caused by a failed circuit board edge connector which prevented the operator from resetting the SGFP speed controller and restoring feed.

Immediate corrective actions included replacing the circuit board and connector, and inspecting like SGFP speed controllers for similar problems. A SGFP speed controller alignment procedure including functional test will be written, and this event will be included in the

next cycle of Instrument Maintenance continuing training.

END OF ABSTRACT

TEXT PAGE 2 OF 6

I. DESCRIPTION OF EVENT

At 1050 on May 2, 1991, a Low Steam Generator (SG) Level Reactor Protective System (RPS) Trip occurred at Calvert Cliffs Unit 2 while attempting to control SG level oscillations at low power level. At the time of the trip, the plant was in MODE 1 (Power Operation) at 8 percent power. The low SG level was caused by a loss of feedwater event when the operating SG Feed Pump (SGFP) was lost due to a speed controller problem.

On the morning of May 2, 1991, Licensed operators reduced reactor power in order to take the Unit 2 Main Generator off-line. The Generator was taken off-line in order to perform a balance shot on the No. 11 Main Generator Bearing. During the course of reducing reactor power, SG level oscillations were experienced in both SG's. To obtain more stable levels, operators varied SGFP speed control as well as Main Feed Regulating and Bypass Valve controls. This was being coordinated with a slightly positive plant moderator temperature coefficient of reactivity. The No. 21 SGFP was in service at the time. At 1010 the reactor achieved a stable power level between 7-8 percent and at 1035 the Main Turbine was taken off-line. From 1010 until the loss of feed occurred, the Unit 2 SG levels continued to vary while operators shifted the No. 21 SGFP controls between Manual and Automatic, and controlled level using the Main Feedwater Regulating Bypass Valve controls.

In order to understand the event, a brief discussion of the SGFP speed control system is included (see attached figure). The Unit 2 SGFP speed control system is unique to Unit 2, and may be controlled in either a manual or automatic mode. Selection of the pump operational mode is made at the pump station. In the automatic mode, a feed flow differential pressure signal is fed to the track and hold circuit board to be compared to a signal from a local start-up station. In manual, an operator has to set the speed signal for this comparison. The function of the track and hold circuit board is to prevent a loss of feedwater controller signal from shutting down the SGFP. In the event that a feedwater control signal decreases a greater percentage than the track and hold loss setpoint (about 4 percent) over a 10 millisecond sampling period, a "Hold" status results, locking in the pump speed at close to the "last best" controller signal level. Hold status is indicated on the control panel by a "Failure Hold" indicator light and also sounds an annunciator. Operators may reset the speed controller to immediately restore feed flow

to its desired value by matching the signal levels and switching a Track and Hold Reset Toggle. Properly shifting control requires that the manual and automatic signal levels are matched within this 4 percent to prevent an undesirable hold mode.

At approximately 1045 while shifting the No. 21 SGFP control mode from manual to automatic, a mismatch in the control and feed flow signals caused the feed pump speed controller to lock into the hold mode, reducing pump RPM in the process. The reason for the mismatch could not be exactly determined, but it is possible

TEXT PAGE 3 OF 6

that either the operator failed to properly verify matched signals or a variance in the feed flow differential signal occurred. SGFP discharge pressure dropped to approximately 500 psia, down from over 1000 psia, and was not sufficient to feed the SG. When the operator matched signals and attempted to toggle the Track and Hold Reset, the speed controller would not reset. Several attempts were made to reset the hold mode with no success. Recognizing that a loss of SG feedwater flow was occurring, the licensed operators entered the Abnormal Operating Procedure for this event, AOP-3G (Malfunctions of Main Feedwater System), and Operating Instruction 12A (Main Feedwater) in order to attempt starting of the second SGFP. Shortly afterwards, when SG level was verified at almost -40 inches, the Shift Supervisor ordered a manual Reactor Trip. The manual reactor trip was not implemented before an automatic reactor trip occurred seconds later at 1050.

Following the event, Instrument Maintenance technicians discovered a damaged edge connector inside of the No. 21 SGFP speed controller. The connector was damaged in such a manner as to prevent the reset signal on the track and hold circuit board from receiving any signal from the Reset Toggle. The edge connector pins for the reset signal were spread wide and made poor contact with the foil on the circuit board. A wire in the back of the speed controller that was connected to the circuit board was found to have been kinked in several locations, and although the kinks could have been created by multiple causes, it is possible that this wire had been caught in the connector several times. The excessive force required to make a good fit between the circuit board and connector as well as to overcome the possible interference from the wire could have resulted in the damage over the years. The last maintenance activity on this cabinet was a routine calibration which occurred during the first week in March of 1991. This calibration was conducted using a technical manual which provided no functional retest.

II. CAUSE OF EVENT

This event was caused by component failure. The edge connector for the Track and Hold circuit board had relaxed contactors that prevented the proper resetting of the speed controller. In the course of transferring modes of operation, a hold signal was generated which could not be reset due to these poor contactors.

Also recognized as a possible aid to early detection of the failure would have been the inclusion of a shop test following routine calibration of the cabinet. Though it is not always possible to test each and every signal function on a circuit board which is removed and reinserted from its connector, a retest might have detected the worn edge connector.

TEXT PAGE 4 OF 6

III. ANALYSIS OF EVENT

The worst case loss of feedwater event described in the Calvert Cliffs Updated Final Safety Analysis Report is a simultaneous closure of both Main Feed Regulating Valves from 100 percent power. Considering that the event was initiated from only 8 percent power, the second SGFP was available, and there was early detection and timely corrective action taken by the plant operators, there was no safety significance associated with this event.

Additionally, it is unlikely that this event could have been initiated at 100 percent power since the SGFP control system is self regulating in automatic control, SG levels are extremely stable, and operational mode shifting is unnecessary at high power levels. No protective limits are violated in this scenario since there are a number of RPS trip features which provide protection. Based on the above, the occurrence of the event would have had no safety significance.

Since this event resulted in an unplanned RPS actuation and attendant plant trip, it is reportable in accordance with 10 CFR 50.73(a)(2)(iv).

IV. CORRECTIVE ACTIONS

Immediate:

1. Plant Operators took appropriate immediate actions to stabilize the plant in accordance with Emergency Operating Procedures (EOP)-0 (Post-Trip Immediate Actions) and EOP-1 (Reactor Trip).
2. The connector for the Track and Hold circuit board was replaced.

3. The pinched wire was disconnected and insulated with heat shrink and rolled up so as to prevent its interference with the connector.
4. A new Track and Hold circuit board was calibrated and installed.
5. The No. 21 SGFP speed controller was tested satisfactorily.
6. The No. 22 SGFP speed controller was thoroughly inspected for a like failure. No such failure was found and the pump tested satisfactorily.

Actions to Prevent Recurrence:

1. This event will be covered during the next Instrument Maintenance Continuing Training SGFP speed controller session.

TEXT PAGE 5 OF 6

2. Electrical and Control Maintenance will write a procedure to address the alignment of the SGFP Speed Control System to include a functional test.
3. Other administrative controls to address this concern will be implemented in the interim.

V. ADDITIONAL INFORMATION

A. Table of Components and Systems Receiving Mention in this LER

IEEE 803A/83 IEEE 805/84

Component or System Funct. Ident. System Code

Steam Generator SG N/A

Reactor Protection System N/A JC

Main Generator TG TB

Main Feed Regulating Valve FCV SJ

Steam Generator Feed Pump P SJ

Speed Controller SC SJ

Edge Connector CON N/A

B. There are no other similar reportable events at Calvert Cliffs.

TEXT PAGE 6 OF 6

Figure 1 "Electronic Diagram, Signal Processor" omitted.

ATTACHMENT 1 TO 9106050263 PAGE 1 OF 1

BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER o P.O. BOX 1475 o BALTIMORE, MARYLAND 21203-1475

R. E. DENTON
GENERAL MANAGER
CALVERT CLIFFS May 31, 1991

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 2; Docket No. 50-318; License No. DPR 69
Licensee Event Report 91-005, Revision 00

Gentlemen:

The attached report is being sent to you as required under 10 CFR 50.73 guidelines. Should you have any questions regarding this report, we will be pleased to discuss them with you.

Very truly yours,

RED/REF/bjd
Attachment

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
L. E. Nicholson, NRC
R. I. McLean, DNR

J. H. Walter, PSC
Director, Office of Management Information
and Program Control

*** END OF DOCUMENT ***
